

Roots set  $f(x) = 0$

$$0 = (x+3)(x-5)(2x-1)$$

$$x+3=0$$

$$x=-3$$

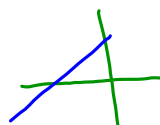
$$x-5=0$$

$$x=5$$

$$2x-1=0$$

$$x=\frac{1}{2}$$

\* all roots are LINEAR  $\Rightarrow$



Degree: 3  $\Rightarrow$  opposite end behaviours

Leading Coefficient (L.C.) POSITIVE

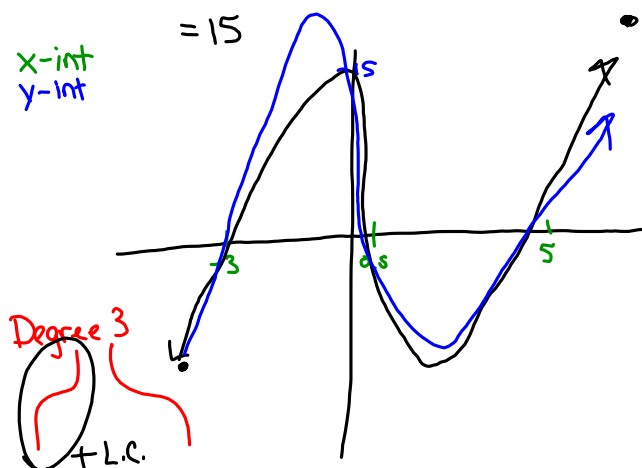
\* look at highest exponent

Y-Intercept: set  $x=0$

$$f(0) = 2(0)^3 - 5(0)^2 - 28(0) + 15$$

$$= 15$$

x-int  
y-int



TRY:

$$1.) f(x) = (x-4)(2x+1)(x-3)$$

$$2.) f(x) = x^4 + 3x^3 - 3x^2 - 7x + 6$$

as  $x \rightarrow \infty$ ,  $y \rightarrow$

as  $x \rightarrow -\infty$ ,  $y \rightarrow$

# RATIONALS

Graph  $f(x) = \frac{x^2 + 5x + 6}{x^2 + 6x + 8}$   $f(x) = \frac{p(x)}{q(x)}$

Simplify the function by factoring:

$$f(x) = \frac{(x+2)(x+3)}{(x+2)(x+4)}$$

① Do I have any matching brackets?

Yes  $\Rightarrow$  We have a HOLE.

Where is the hole?

$x+2$  would cancel out. (is the matching bracket)

$$x+2=0 \quad \text{NEED a y-coordinate!}$$

$$x = -2$$

Sub  $x = -2$  into simplified  $f(x)$ .

$$f(x) = \frac{x+3}{x+4}$$

$$f(-2) = \frac{-2+3}{-2+4} \quad \therefore \text{hole happens at } (-2, \frac{1}{2})$$

$$= \frac{1}{2}$$

\* the function does NOT exist at a hole.

② Look for Vertical Asymptotes (V.A.)

Set denominator = 0 and solve for x

$$x+4=0$$

$$x = -4$$



③ Look for Horizontal Asymptotes (H.A.)

\* look at coefficients of highest degree terms

Random examples:

$$\frac{x^2+7}{x-3}$$

$$\Rightarrow \frac{x^2+7}{x-3}$$

$$\text{H.A. } y = \frac{1}{0} \text{ UND.}$$

$\therefore$  do division to find asymptote

$$\frac{x+4}{x^2+7}$$

$$\Rightarrow \frac{x^2+x+4}{x^2+7}$$

$$\text{H.A. } y = \frac{1}{0} = 0$$

$$\frac{3x^3+7}{9x^3-9}$$

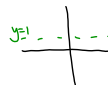
we have  $x^3$  on top and bottom

$$\text{H.A. } y = \frac{3}{9}$$

$$\text{Our function: } f(x) = \frac{x+3}{x+4}$$

$$\text{H.A. } y = \frac{1}{1}$$

$$y = 1$$



④ X-Intercept: Set  $y=0$

$\therefore$  set numerator = 0

$$x+3=0$$

$$x = -3$$

⑤ Y-Intercept: Set  $x=0$

$$f(x) = \frac{x+3}{x+4}$$

$$f(0) = \frac{0+3}{0+4}$$

$$= \frac{3}{4}$$

⑥ Look for End Behaviours

choose a "large" x value

and a negative "large" x value

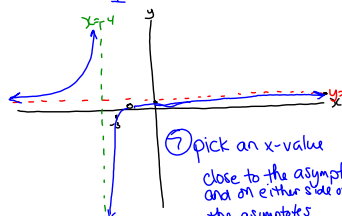
we choose to sub in 1000

$$f(1000) = \frac{1000+3}{1000+4}$$

$$\approx 1$$

$$f(-1000) = \frac{-1000+3}{-1000+4}$$

$$\approx 1$$



⑦ pick an x-value close to the asymptote and on either side of the asymptotes

check  $x = -5$

$$f(-5) = \frac{-5+3}{-5+4}$$

$$= \frac{-2}{-1}$$

$$= 2$$

TRY:

$$1) \frac{1}{x^2-4}$$